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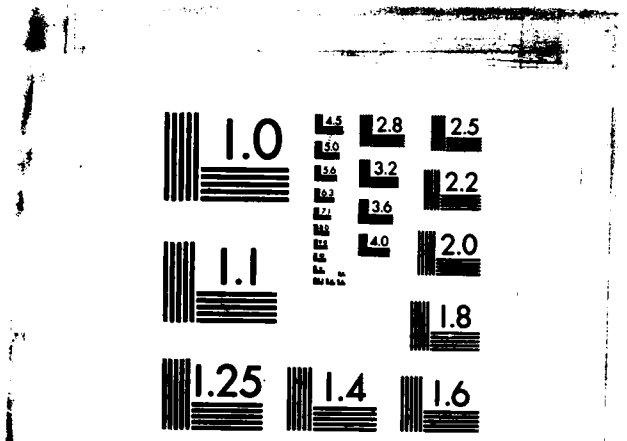

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REQUIREMENTS ANALYSIS FOR MILESTONE TRACKING SYSTEM

FINAL REPORT - VOLUME II

DECEMBER 1, 1983

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REQUIREMENTS ANALYSIS

FOR

MILESTONE TRACKING SYSTEM

FINAL REPORT - VOLUME II

December 1, 1983

Sponsored by

Defense Advanced Research Projects Agency

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1.0 BACKGROUND/APPROACH

This report documents work performed by Meridian Corporation under contract No. MDA903-83-C-0342. Volume II of this report concerns the efforts undertaken with respect to a Milestone Tracking System. The purpose of this task was to analyze the feasibility and cost effectiveness of developing a milestone tracking system for internal use within DARPA which was capable of utilizing existing DARPA data bases. As defined in this document, milestones include a wide range of internal and external developments as well as decision points which may be of interest to DARPA managers. Specifically, these include:

- Technical achievements;
- Technical decision points;
- Financial decision points;
- Points of inter-project dependencies; and
- External events/considerations.

The purposes initially identified for a milestone tracking system were threefold. First, the system was envisioned to be a mechanism to provide program managers with a concise representation of their program activities. Such activities might include internal reviews, project accomplishments, financial milestones, program interfaces, and events of public interest. Second, the system was conceived to provide an automatic prompting of milestones and/or critical events identified by the user. Third, the system was viewed as a mechanism to retain an historical data base on the conduct of DARPA programs. However, upon closer examination of user requirements, it soon became evident that the system also had utility in providing input to reprogramming decisions through the analysis of imbedded dependency networks. The potential for this application is analyzed in Section 2.0.

At the outset, the milestone tracking system was conceived as a centralized MIS application, similar in nature to the system designed to address forward

funding. Potential users were identified and queried concerning their personal requirements for a milestone tracking system. Representatives were interviewed from each potential user group within DARPA, including the PMO Director's Office, the Program Management Office, Technical Offices, Financial Management Division of PMO, and MISD.

Based upon the interviews conducted with these diverse individuals, several common concerns were raised. Foremost among these concerns was the perception that exiting milestone tracking systems (maintained on hard copy mostly) were adequate for most users. This viewpoint was almost universally held, with a notable exception being the PMO Director's Office. In addition, it was widely believed that the requirements for data entry would be overwhelming to a staff which was already fully utilized. This problem was particularly noted in places where the availability of support staff was limited. Further, because of the classified nature of many program milestones, the security of access to the data was perceived to be a formidable obstacle to the successful implementation of a centralized system. Finally, a few potential users expressed reservations concerning their ability to monitor the integrity of the data once it was input to the data base, and some feared that unauthorized access to information about their programs may prove to be detrimental.

Because of these four reasons, a centralized MIS application did not appear to be warranted. However, considerable interest was expressed in an interactive microcomputer application. Such an application would have utility primarily within PMO, principally for the Director's Office but also for Program Management Officers. The system, as in the case of the Forward Funding Tracking System, was necessarily constrained to rely on existing data sources, while accenting the benefits obtainable from automated analysis and interpretation. In addition, a principal opportunity that the system might realize was in the maintenance of historical records of planned versus actual performance so that the memory of a

program's progress might be sustained through personnel changes, baseline changes, and funding redirection.

Several potential user requirements were identified for an interactive microcomputer application. Foremost among these requirements was the need for the system to be sufficiently interactive that it may be considered "user-friendly" by professionals who are not computer-oriented. Second, the system needed to be sufficiently flexible to permit the user to tailor meaningful outputs to respond to a variety of special situations. Third, a series of needs was identified relating to the system's ability to sort milestones by a wide range of parameters, including the importance of the milestone (as judged by the user), the time horizon in which the milestone occurs, the Technical Office sponsoring the program, and the financial implications of the achievement of (or the deviation from) the milestone. This last capability implies the construction of a dependency network to some level of detail, which in turn may indicate a fruitful area for interface with the Forward Funding Tracking System described in Volume I. Finally, as noted earlier, the last functional requirement placed on the system was the need to maintain an historical record of milestones as they are scheduled, as they are achieved, and, in the event of slippagges, the reasons why deviations from schedule occurred.

In response to these four requirements, Meridian has constructed prototype output report which address the identified milestone tracking needs. These output reports and preliminary indications of how they may be utilized are described in Section 2.0.

2.0 REQUIREMENT

In order to effectively maintain programmatic control over DARPA research efforts, the Director of the Program Management Office (PMO) must have access to schedule and performance data for all projects. These data currently exist in a totally manual form -- periodic project status briefing reports are sent in to the Director's Office where they can be referenced visually. An automated method of storing and accessing this data would allow the Director to stay abreast of the status of ongoing projects more efficiently, to anticipate problem areas, and to identify potential program/schedule/budget impacts. This section describes the specific parameters of such an automated project schedule support system.

2.1 Data Entry

Data for automated milestone tracking will come primarily from the progress status briefing reports sent to the Director, PMO. The data elements will be keyed interactively into an IBM Personal Computer by a data entry clerk. The Director or a designated analyst will need to be involved with determining and entering certain data elements (specifically dependency information and priority designations). Data will consist of two specific types -- header (identifying) information for each project and characteristic data concerning each milestone. Project header information will consist of:

- Project title
- Contractor name(s)
- Technical Office assigned to
- Identification code (unique for each project, could include Technical Office designation and possibly type of project code)

Milestone-specific information will consist of:

- Milestone title (descriptive)

- o Milestone identifier -- unique code also designating the type of milestone (such as start date, completion date, program review, etc.)

- o Priority designation -- the Director will have the ability to identify those milestones which should be assigned particular importance

- o Schedule Date(s) -- the quarter(s) in which the milestone is expected to be achieved (this will be a multiple field to accommodate schedule revisions, each of which must be stored and retrievable)

- o Actual completion date

- o Preceding dependencies - list of the milestone identifiers which must be completed before the activity which cumlinates in this milestone begins

- o Succeeding dependencies -- list of the milestone identifiers, the subsequent activities which cannot begin prior to the completion of this milestone.

There are two particularly salient points concerning data elements which must be discussed, namely:

1) Milestones must be limited to those events which are measurable and achievable, such as "Begin Contract" or "Conduct Preliminary Program Review". Decision points should be included as milestones where appropriate.

2) Care must be taken in determining milestone dependencies. For the sake of processing simplicity, dependencies should be limited to those relationships between the completion of one milestone and the commencement of the activity leading to the dependent milestone. It is therefore necessary to determine and enter a milestone which corresponds to the beginning of the dependent activity.

2.2 Report Generation

The basic output format for this system will be a graphic representation along a time line of the schedule status of a project or projects. Output reports must also be able to be tailored to satisfy a particular report requirement. The specific report generation options which must be available are:

- o Selection -- inclusion of only those projects, milestones and/or data items which satisfy user defined parameters, such as:

  - Only those projects in a particular office

  - Only those projects of a particular type

- Only those milestones which occur after the first quarter of a given fiscal year

- Only those milestones of a particular type

- Only the latest scheduled date for a milestone

o Sorting -- grouping of project milestone charts in a fashion designated by the user, such as by Technical Office, project type, or completion milestone by time

o Summarization -- compressing the multiple project milestones into a single line representation, perhaps a bar with some user-selected milestone symbols added

o Dependency analysis -- the ability to display in a condensed manner, those milestones which have defined interrelationshi

o Option combinations -- the ability to mix and match report generation options discussed above into any combination.

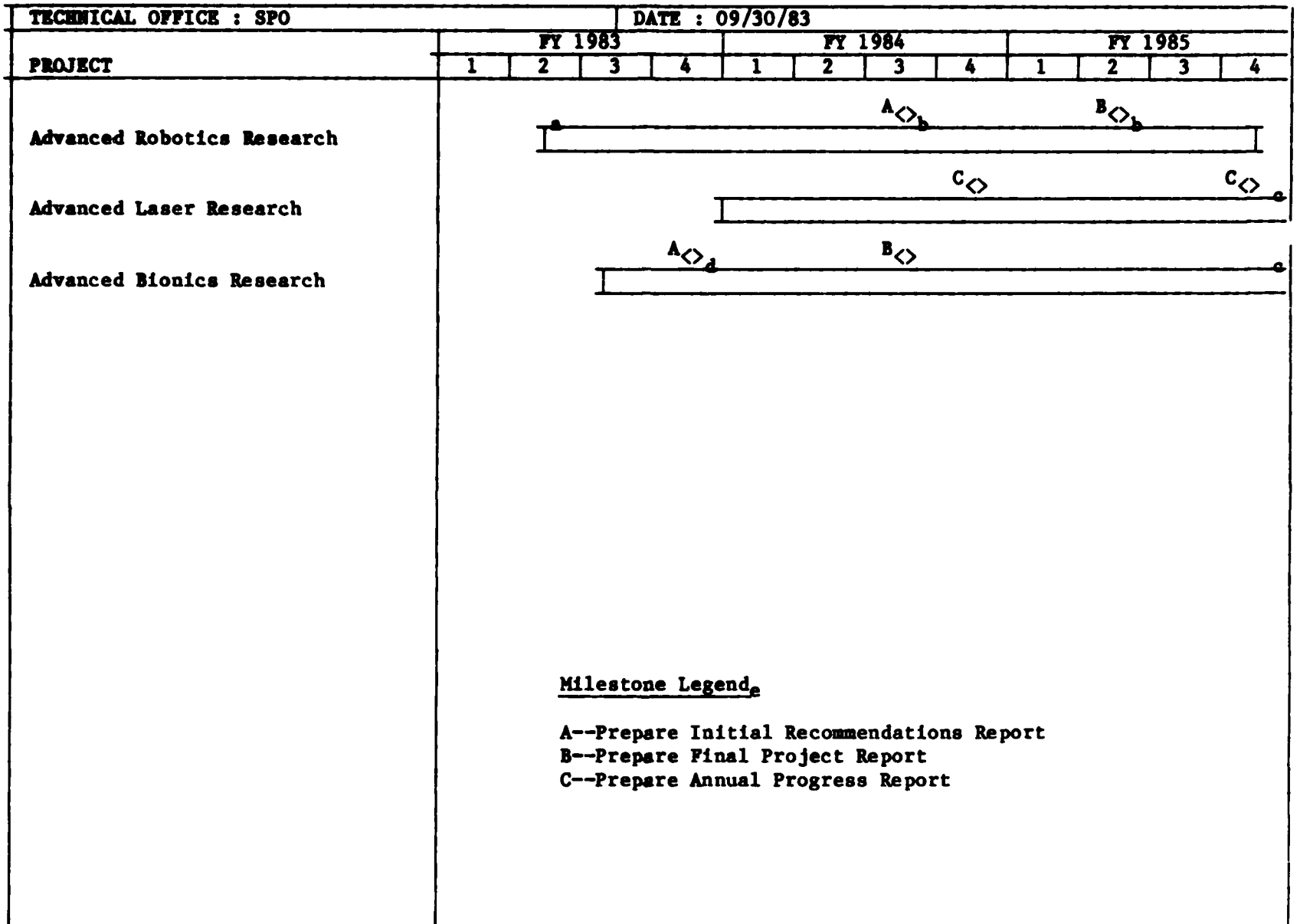
Figure 2-1 through 2-6 provide rough examples of the ki reports which should be available from the milestone tracking system. Special features of each are noted where appropriate.

Figure 2-1 Project Milestone Sample Report

PROJECT TITLE : Advanced Robotics Research							TECHNICAL OFFICE : SPO							
CONTACTOR NAME : Robitron International (prime), several subcontractors									DATE : 09/30/83					
	FY 1983				FY 1984				FY 1985					
MILESTONES	1	2	3	4	1	2	3	4	1	2	3	4		
Begin Basic Studies		◇a												
Conduct Preliminary Project Review				◇	1◇b									
Prepare Initial Recommendations Report						◇	1◇							
Conduct Final Project Review									◇	1◇				
Prepare Final Project Report											◇	1◇		

Notes
a--Filled-in diamond indicates completed milestone
b--Superscript numbers indicate schedule revision versions

Figure 2-2 Milestone Summary Sample Report



Notes

a--Start date taken from a "start" milestone

b--User defined inclusion of only the latest scheluled date for each milestone (as opposed to original or all)

c--End of project extends beyond FY 1985

d--Filled in diamond indicates completed milestone

e--User selected that only report milestones be included

Figure 2-3 Sorted Milestone Summary Sample Report

TECHNICAL OFFICE : SPO	DATE : 09/30/83											
	FY 1983				FY 1984				FY 1985			
PROJECT	1	2	3	4	1	2	3	4	1	2	3	4
Advanced Satellite Technology			A<>a,b									
Cryogenic Analysis			A<>									
Project Alpha			A<>									
Project Psi					A<>							
Project Gamma							A<>					

Milestone Legend[c]

A--Review Briefing

Notes

a--User-selected option to display only milestones, not bar depicting total activity

b--User-selected option to sort projects by earliest occurrence of selected milestones

c--User chose to display only Review Briefing milestones

Figure 2-4 Priority Project Milestone Sample Report

PROJECT TITLE : Project Icebreaker					TECHNICAL OFFICE : SPO							
CONTACTOR NAME : Admiral Perry Associates									DATE : 09/30/83			
	FY 1983				FY 1984				FY 1985			
MILESTONES[a]	1	2	3	4	1	2	3	4	1	2	3	4
Initiate super-heating studies			◇[b]									
Complete super-heating studies						◇						
Prepare interim project briefing							◇					
Select super-heating alternatives									$^{1}◇_{c}$	$^{2}◇$	$^{3}◇$	
Complete Phase II analyses												$^{1}◇$

Notes

a--User selected option to display only those which he/she had previously designated as priority
b--Filed-in diamond indicates completed milestone
c--Superscript numbers indicate schedule revision versions

Figure 2-5 Project Dependency Sample Report

TECHNICAL OFFICE : SPO			DATE : 09/30/83													
PROJECT CODE/[a] MILESTONE[b]	IND[c]	DEP[d]	FY 1983				FY 1984				FY 1985			
			1	2	3	4	1	2	3	4	1	2	3	4
SP102-Complete studies	X				◇[e]									
SP213-Initiate analysis		X				◇[e,f]								
TT115-Alternative selection[g]	X						◇		[1]◇[h]					
SP435-Conduct advanced studies		X						◇[i]						
SP105-Present final project briefing	X				◇[e]									
SP254-Commence alternative analysis	X	X[j]					◇			◇				
SP312-Initiate final research	X											◇		

Notes

a--Unique identifier for a particular project
b--Only those milestones which have defined dependency relationships will be displayed
c--Designates a milestone which must be completed before the dependent milestone can be begun
d--Designates a milestone which cannot be started until an independent milestone is achieved
e--Filled-in diamond indicates completed milestone
f--Dependent milestone is scheduled after independent milestone and no problem exists
g--Dependency may be with a milestone within another Technical Office's project
h--Schedule revision
i--Dependent milestone is scheduled before the independent milestone's currently planned date, problem exists
j--Certain milestones may be dependent upon another and the independent milestone of another relationship

3.0 CONCLUSIONS AND RECOMMENDATIONS

The narrow range of interest expressed in developing an automated milestone tracking system has led the study team to the conclusion that a single-user, microcomputer-based system is the optimal system alternative. The system design and development analyses to be conducted in Phase II should therefore address the procedures and specific requirements of developing and implementing a microcomputer-based solution. To that end, the tasks which we recommend pursuing in Phase II consist of:

- Developing a system design specification for a microcomputer-based system. Particular emphasis should be paid to determining the degrees of user-friendliness and user flexibility required
- Preparing an implementation plan for system development, implementation, and maintenance. Specific topics to be addressed include costs, schedules, training requirements, procedural impacts, and data requirements
- If funding permits, initiating software development. The more narrow (as opposed to a centralized application) scope of the recommended solution will foreshorten the "Solution Space" analysis resource requirements. At the discretion of the COTR, the implementation of the milestone tracking system can be accelerated by using the remaining funds to initiate software development.

In addition, owing to interrelationships between milestone tracking and other management functions undertaken at PMO, Meridian recommends that the Phase II efforts also include:

- The expansion of the scope of the system to include a lower level of program milestones
- The definition of mechanisms which will identify, on a continuing basis, the financial implications of program milestones
- The identification of commonalities between milestone tracking and the management of DARPA resources.

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